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The use of selected community groups to elicit and understand the values underlying attitudes towards biotechnology

Joanna Gamble and Elsa Kassardjian

Focus groups were used to examine the social, cultural and spiritual dimensions of biotechnology through an analysis of five selected community groups (total $n = 68$): scientists, Buddhists, business people, mothers with young children and the environmentally active. Participants from all groups were united in their perspective on three of the value spheres explored: health and welfare of family/society; maintaining/preserving the environment; and ethical considerations (e.g. welfare of animals, sanctity of life). However, values regarding science and business differentiated scientists and business people from the remaining community segments. Business people were more likely to adhere to “productionism,” resulting in a greater acceptance of biotechnology, since business people did not hold the same resentment toward the business sphere held by other community segments. Scientists were far more accepting of the norms and values inherent in the sphere of science, believing science to be more predictable and controllable than general public perceptions. The disparity in worldviews for this value sphere meant scientists and laypeople did not communicate at the same level, in spite of having the same concerns for health and the environment. This resulted in feelings of frustration and powerlessness on the part of the layperson and the scientist.

1. Introduction

A considerable amount of research has been conducted in the area of public attitudes and perceptions of biotechnology over the past ten years. The bulk of the studies have used quantitative techniques that aim to assess the prevalence of opinion, rather than explore the underlying values and beliefs (e.g. Cook et al., 2004; Gamble and Gunson, 2002; Alexander and Toner, 2004; Gaskell et al., 2003).

Qualitative studies include those by Gamble (2001), Hunt et al. (2003), NFO (2003) and Shaw (2002). Beliefs regarding the spheres of science, spirituality, business/technology, nature/environment, and family/society frequently emerge in these discussions (Gamble, 2001; Small, 2003). Such beliefs can be organized in the form of non-rational mental maps that help to organize thoughts dealing in matters beyond human reasoning, telling us where we have been and where we are going and thus helping us come to terms with the world (Fisher et al., 2000; Gamble and Fisher, 2002). While they are based more on tradition and convenience than fact, they also reflect what is perceived or hoped to be real.

The current project

While we are all members of many different community groups simultaneously (for instance a woman can also be identified as a mother, a business person and a Buddhist), it is expected that membership to a group requires a shared culture and values inherent to that group. What we wish to explore is whether there are segments of the community that might identify more strongly with certain value spheres than others. If this is the case, it is likely that they may hold attitudes toward biotechnology that are distinct from those of other segments of the community. However, there are also likely to be areas of shared ground between different segments. To explore these similarities and differences, we chose five groups of participants: scientists, Buddhists, business people, mothers of young children and environmentalists, reflecting beliefs that are commonly observed to impact on attitudes towards biotechnology (i.e. science, spirituality, business/technology, nature/environment, and family).

In this study, the main research question was to assess how the values in these five spheres would impact on specific members of the public when determining their attitudes toward biotechnology, and to determine if any of these values were of greater significance than the others in each community segment. Specifically, we have five hypotheses.

Hypothesis 1: encouragement for biotechnology may reflect respondents' exposure to, and support for, the culture, values and power of science (Priest, 2000). It would be expected that scientists are more likely to adhere to the scientific myth (we will find our salvation in science) than other members of society, resulting in a greater acceptance of biotechnology applications.

Hypothesis 2: an ecocentric ethic is grounded in the whole ecosystem and guides the thinking of most deep ecologists, spiritual ecologists, Greens, cultural eco-feminists, organic farmers, bio-regionalists, and most indigenous peoples' movements. Everything is connected to everything else, and no part of the ecosystem can be altered without altering the dynamics of the cycle (Merchant, 1992). Members of society who commit time and effort to conservation may well possess such beliefs to a stronger degree than others who do not. The role that the environment plays in the lives of these people is expected to influence their attitudes to biotechnology to a greater degree than other community groups.

Hypothesis 3: Buddhism is built on the tenet that everything in the universe is interrelated (in the sense that there is a genuine intermingling of parts of the ecosystem). It espouses the viewpoint of biocentrism (biospherism), or ecocentrism (Merchant, 1992), and hence self-transcendence (Loy, 1999). We consider that other researchers in New Zealand have adequately covered the Judeo-Christian perspective (e.g. Coyle et al., 2003). It is expected that the attitudes to biotechnology of members of this group will be explained to a greater extent by their spiritual beliefs than for the other groups.

Hypothesis 4: the tenet that "more is better" is central to the myth of "productionism." Progress is a good thing and problems can be solved by the application of technology. It is a dominating theme of much of science, agriculture, business and technology. We believe that business-minded people (such as those who own their own business) may be strongly influenced by such beliefs when forming their attitudes regarding biotechnology. Additionally, a strong link has been demonstrated between anti-corporatism and environmentalism (Gamble, 2001). If this is so, we expect that those with strong environmental values may also be strongly resentful of the role of business in biotechnology. We also expect that those who are more comfortable with the values inherent in the business world will be more accepting of the perceived motivations of biotechnology industries, and hence more accepting of the technology.

Hypothesis 5: the difference between men and women is one of the most commonly cited differences in attitudes towards biotechnology (Hamstra, 1998; Baghurst, 1999). In addition, the

presence of children in the home may impact on food choice because of its potential association with higher food risk aversion or quality consciousness. Parenting may also trigger a focus on nutrition, yielding a search for nurturing benefits through the provision of wholesome foods (Verbeke, 2005). A focus on protection of family is expected to be more important in determining their attitudes towards biotechnology than for other groups.

2. Methodology

Focus groups

Because the specific objective of our research was to examine the social, cultural and spiritual dimensions of biotechnology through an analysis of a variety of community groups, we decided that the use of focus groups would be most appropriate (see Gregory (1995) or Morgan (1988) for a discussion on the merits of focus groups). Focus groups are useful when topics of attitudes and cognitions need to be explored.

Description of participants

A total of 68 people took part in the research. The same experienced moderator was used in all the groups. Groups were video-taped, and voice-recorded, and participants were paid for attending.

Two focus groups were conducted for each category:

- Scientists ($n = 17$): we asked scientists from the Horticulture and Food Research Institute of New Zealand to be involved. Invitation was by e-mail to all the scientists, requesting people from all areas of research regardless of knowledge or opinion on the topic of biotechnology.
- People with specific religious beliefs (in this case, Buddhists) ($n = 13$). Participants came from a Buddhist center in Auckland, New Zealand.
- Mothers with young children ($n = 12$) from within the Auckland region were selected by a market research company.
- Business people ($n = 14$) from within the Auckland region were recruited by the same market research company. We asked for participants owning their own company.
- Environmentalists ($n = 13$) from within the Auckland region: all participants were involved in environmental conservation.

All the focus groups took place in Auckland, New Zealand, at HortResearch in October 2003 (prior to the lifting of the moratorium on applications for release of genetically modified organisms).

Selection of discussion topics

One of the main research questions was to assess how the values in these five spheres would impact on specific members of the public when determining their attitudes toward biotechnology, and to determine if any of these values were of greater significance than the others in each community segment. Additionally, we wanted to know how New Zealanders saw the place of these values in the decision-making process. At what stage did the public believe that such values should take precedence over the fact that a biotechnology application might be "scientifically safe"?

We identified six existing or potential developments to use as a means of revealing some form of value hierarchy inherent in decision-making about acceptability or unacceptability (see below). We attempted to present a range of applications currently under development that would draw out frequently voiced issues involving: food vs. medicine; high intervention vs. low intervention; human vs. plant gene source; commercial vs. altruistic; and familiar vs. unfamiliar.

Of note, the study was conducted just before the lifting of the moratorium on application for release of genetically modified (GM) organisms. We therefore took the opportunity to question the participants about their perceptions of the debate, who they believed the key players to be, and their attitudes towards the regulatory procedures at the time.

In summary, based on the literature review presented previously, the discussion centered on the following topics:

- Current awareness and understanding of the terms “biotechnology” and “genetic modification” (in the following, we refer to this question as “Understanding”).
- Imagery/associations and their sources (referred to as “Imagery”).
- Perceptions of the current debate on genetic modification/biotechnology and of its key players (“Perception of the debate” and “Key players”).
- Opinions regarding the technology in general (“Opinion”).
- Opinions regarding specific biotechnology applications (“Specific opinions”) differing in their use (food, medical or environmental preservation), the “vector” (tobacco plants, cows, human embryos), and the origin of the gene (human or plant gene). The specific applications queried were:

“An apple that had been developed by selecting only those with genes for excellent flavor (the genetic structure was not changed so it is non-genetically modified). It uses gene mapping to identify only those plants with the appropriate genotype, meaning breeders don’t have to wait until the plant has grown up and revealed its phenotype before selecting them for further breeding” (non-GM apple).

“An apple that had been genetically modified using a gene from a different kind of apple to improve flavor—currently uses an antibiotic marker (which means you can select only those that are expressing the desired gene) but only uses its own apple promoter (in the past, used viral promoters)” (GM apple).

“Milk from a cow genetically modified with human genes so as to produce human insulin (the insulin would be extracted from the milk, and only be available to diabetics)” (human insulin in milk).

“Stem cell research—for example using embryonic cells for Parkinson’s disease or for spinal injuries. Stem cells are unspecialized, and can potentially be induced to become cells with special functions, such as the beating cells of a heart. However, at this stage, we don’t know what to do to induce those cells to take on those functions” (stem cell research).

“A company called Large Scale Biotechnology is working on an approach they call ‘personalized medicine’ where the gene from an individual human is used to produce a vaccine that can be grown in tobacco plants. A protein is expressed by the plant that is then pumped back into the same patient, causing their immune system to respond appropriately. At the moment they are at phase two of a clinical trial to develop a vaccine for non-Hodgkin’s lymphoma” (personalized medicine).

“DNA fingerprinting of native animals and plants to discover ‘hidden’ species—is an ecological/conservation application that does not involve any manipulation of the genetic structure. So for example, if the population of the rare native kakapo birds on

one island is rapidly dying off, we could use DNA fingerprinting to determine whether another population elsewhere could effectively breed with the remaining birds” (DNA fingerprinting).

- Underlying values and relative importance of those values in forming opinions about biotechnology (“Values”).
- Attitudes to current and future regulatory procedures (“Regulation”).
- Preferred information sources (“Information sources”).

Because the focus groups were exploratory in nature, we did not aim to achieve consensus between the participants of the groups. Indeed, participants were told at the outset that there would be a range of opinions within a group, and that they should therefore respect any differences that arose.

Analysis

All tapes were transcribed. A researcher then went through the transcripts to identify who the speaker of each comment was, and to check the accuracy of the transcription. The completed transcriptions were then analyzed using thematic analysis as described by Owen (1984). A two-step approach was taken:

1. In the first step, the text of the transcripts was entered into Microsoft® Excel 2000 on a question-by-question basis, incorporating group membership and individual number. This allowed development of a coding schedule. This quantitative step ensured isolated comments or verbose respondents were not given undue emphasis.
2. In the second step, two scientists analyzed the transcripts and coding schedules to further develop the themes. Any discrepancies in this qualitative stage were resolved through discussion.

3. Results and discussion

Analysis compared and contrasted the five groups of participants to identify areas where attitudes and beliefs transcended group membership, and areas that defined the groups.

Current understanding

Scientists were the most knowledgeable about biotechnology and genetic modification of the five groups interviewed and the only group who did not perceive biotechnology to be “unnatural.” Environmentalists also had a good understanding of the topic, likely reflecting the degree of personal interest these participants had in biotechnology, and the consequent effort that they exerted to inform themselves. Indeed, with both groups, participants indicated their work was the main source of information (although the environmentalists cited a broader range of sources including the media and friends).

In contrast, mothers appeared to have difficulty in defining “biotechnology” or “genetic modification,” and business people also struggled with definitions. Conceivably with these participants, the issue of biotechnology/genetic modification played a less important role in their lives. As a result, the desire to exert effort acquiring information about the topic was relatively low, given the perceived information overload. In support of this assertion, studies conducted in New Zealand have shown that while biotechnology is a public concern, it is of less

importance than many other issues (Cook et al., 2004). The perception that there is simply too much information to wade through, combined with a relatively moderate level of concern, may result in an over-reliance on the popular media. Indeed, the media was most commonly cited as informing their images of biotechnology among these participants. Participants' terminology was frequently emotional, and tended to elicit negative words and associations reflecting the unknown nature of the technology. This was more commonly the case for the term "genetic modification," where participants used words such as "scary," "unnatural," "interference" and "premature."

Buddhist participants stood slightly apart from the other groups, since although they possessed a moderate understanding of the terms "biotechnology" and "genetic modification," their initial responses also revealed concerns that the technology both reflected and impacted on society's values. This involved issues of desire, greed, and the use of other living things for the benefit of humankind. "One thing I do observe is that there are some very wealthy individuals and corporations that are putting a lot into it ... there's so many factors to it that just go beyond the realm of what I can really comprehend" (Buddhist).

Debate

The debate on genetic modification in New Zealand was seen by all groups as polarized, or conversely, very one-sided (in the negative), reflecting the belief that debate had been very poor, with neither "side" listening to each other. Players on the "anti" side had a higher profile and included such groups as Mothers Against Genetic Engineering (MAdGE) and Greenpeace. Awareness of MAdGE was particularly high, and most groups recognized their communications as doing a good job in highlighting their position, although there was some contention over whether the group was too extreme. In comparison, the communications of Greenpeace were seen as fairly inefficient, although they were recognized as doing good work. Awareness of who the players were on the "pro" side was vague, but tended to include scientists and multinationals. Mothers in particular expressed their need to rely on experts and media to filter the information, since they felt they lacked the time and ability to go back to the primary source of information (scientific publications for example). "I mean that's the sort of thing that you hope the media is going to be trustworthy" (Mother).

In addition to the perceived poor debate, a feeling of powerlessness was apparent in a number of the focus groups, taking several forms. In one respect, participants felt powerless as consumers to avoid GM food (owing to lack of either labeling or money). In another respect, they felt powerless as citizens to influence the decisions they saw being made at a higher level, believing the debate to be inaccessible to them.

I think I would describe the current debate as disempowering. I think no matter what I think or feel, for me the worst scenario is going to take place in this country very soon. (Buddhist)

Yeah, the scientists and stuff responsible for this are just basically standing there saying well hey we snuck it in to the world years before so what are you jumping up and down about? It's not fair, they're just standing there saying well this is it, deal with it and I think that's why everyone's got their backs up. (Mother)

A third form of powerlessness was demonstrated by scientists who indicated a feeling of powerlessness in their perception that they were not listened to by laypeople (whose minds were already set) or politicians (with different agendas).

I gave a very well received talk about biotech and possible effects on honey bees at a beekeepers' conference and everyone, what a good talk ... and one of their remits

pre-decided was that we'd like all GE banned in New Zealand for the next three years and they all voted almost unanimously for that so I thought "Yeah my communication's being well received" but completely ineffective I think because people, you know, they didn't use the information they received to change their view. (Scientist)

Opinion

Biotechnology was not completely rejected by any group, with scientists the most supportive followed by business people. Positive contributions were typically seen to be in the area of health, because of the benefits to those in need, and because it could be contained. The primary concern raised involved unknown long-term effects. While scientists were concerned about potential scientific and economic losses if the technology was not supported, they shared the concern with Buddhists regarding who stood to benefit from the technology. Mothers were the most fearful of biotechnology of the five sectors interviewed.

Specific applications

Apples created using marker-assisted selection gained support from all groups, with participants stating that this was nothing new. However, the introduction of a new gene, even if from another apple caused concern for some participants in all the groups, bar the scientists. Specific concerns were raised regarding the use of antibiotic-resistant markers or the process in general. Buddhists and mothers also expressed a cynicism regarding financial motives. Nevertheless, other participants in these groups felt comfortable with the application, indicating it was nothing new.

Participants recognized the benefits that cows genetically modified to produce insulin in their milk could provide to diabetics, and as a result expressed some positive feelings. Additionally, because the cows would be contained there was the perception that risk of negative impact on the environment would be relatively low. However, across all groups, participants expressed concern for the welfare of the cow, with several Buddhists, and one scientist, expressing an ethical problem with the use of other living things for the benefit of humans.

I'm not a fan of animal biotechnology. I have some issues about using animals as factories and things like that. (Scientist)

As long as the poor old cow doesn't get so stressed that it goes bonkers. (Business person)

The stem cell research scenario provided an unexpected finding, in that few groups rejected the application outright (including the mothers), and few ethical concerns were raised. In this scenario, the recipient had the choice of receiving the procedure. Provisos to this research were that there was no way the embryos would have become a life, that nothing was harmed and that strict regulations and controls were put in place.

If there was no chance that they would be used to become a life, a baby, it would help other people, and I don't see anything wrong with it. (Mother)

Well with personal choices involved and specific results for one person and where the embryo is coming from a person who is willing to donate that embryo rather than these being unleashed on the general population in some form or another I think that's a personal choice. (Environmentalist)

In fact, one Buddhist participant indicated they would rather have this than the application using cows. Nevertheless, among Buddhists, the application provided a philosophical point of

argument regarding the stage at which medicine started interfering with the natural order of life and death.

Buddhists and environmentalists were skeptical that the application regarding personalized medicine would be available to those who could not afford it, while scientists and business people voiced few concerns over the application. Mothers were initially fearful and questioned the impact that the procedure might have on the population (i.e. improved health, increased longevity), but participants' personalized stories tended to increase acceptance.

Yeah, but I'm skeptical of all that sort of thing because nobody makes money out of people that are well. (Environmentalist)

I mean I have two parents who died of cancer. (Mother)

While DNA fingerprinting was very acceptable to mothers, environmentalists and business people, scientists and Buddhists responded quite negatively to the application. Participants in both groups felt that the cost of the process would be expensive, and that the money could be better spent in other conservation efforts, as typified by the comment, "huge amounts of money are poured in to trying to reconstruct extinct birds when others are becoming extinct through lack of resources" (Scientist). In addition, both scientists and Buddhists felt it did not encourage care for the existing environment. "I think it leads to carelessness in the future towards the wellbeing of our planet and how we sort of stew in it really" (Buddhist).

Values

Science

Not unexpectedly, values involving science played a major role in terms of forming scientists' attitudes towards biotechnology. A number of the participants felt strongly about the importance of science to the extent that several referred to it as their religion. Their ease with the culture and values inherent in science was consistent with their profession as scientists. Of the other four groups, business people were the only ones to view science positively as progress. However, even with these participants, an undercurrent of fear was discernable in their concern that scientific developments could be misused. Mothers, environmentalists, and Buddhists expressed a related concern commenting that scientists/science were untrustworthy and fallible. These beliefs may be related to the feeling of lack of control, as illustrated by consistent requests for strict regulations. Buddhists and environmentalists also revealed their belief that scientists arrogantly believed in their infallibility, and lacked inherent ethics.

Yes, that's the scary part. Science, I don't trust science to stop and keep within the boundaries and guidelines because that's not the nature of a scientist. (Mother)

You can bet your bottom dollar there's someone out there somewhere who's got no ethics or has been paid for cloning the super sportsman or super soldier. (Business person)

In the modern world science seems to be the god, and they're sort of explained ... claimed to be the knowledge bearers of humanity. (Buddhist)

Business

Business people were the only group who did not feel negatively towards the value sphere of business, suggesting that the participants in the business groups were more comfortable with the norms and values embraced by the business world.

A number of our non-business respondents revealed symptoms of "consumer alienation" as detailed by Allison (1978). Underlying constructs of this alienation include feelings of

powerlessness (a feeling of being unable to determine market practices, an inability to control the market environment or events within the marketplace), normlessness (a distrust of business and market practices), social isolation (feelings of estrangement from institutions, practices and outputs of the commodity market system) and self-estrangement (inability to identify with behavior traditionally associated with the consumption role). For instance, while both business people and scientists recognized the close relationship between business and science, scientists expressed frustration that their research was often constrained by business/financial considerations. Among the environmentalists, mothers, and Buddhists, a feeling of resentment was apparent with regard to the control and power that “big-business” had over their lives, which they saw as having a detrimental impact on society and family.

Why does Monsanto need to come along and make trillions of dollars out of telling us what we should eat? (Environmentalist)

It is just a way of making massive money, and actually dominating the food. (Mother)

It's greed and it's actually business people and advertising and all that actually promote its value in our society, greed isn't it, craving you know “you're worth it,” “do it now,” all that sort of thing. It's the society—we are actually encouraging these sorts of values. (Buddhist)

Here, people were concerned about the control that big-business had over the food supply, and the consequent quality of food they fed their families. Concern was also expressed over the role of money, which these participants felt led to a widening of the gap between rich and poor (Buddhists) and short-term decision-making (mothers).

Cook et al. (2004) identified the belief that biotechnology is a technology for doing useful things, ultimately advancing society (“tech optimism”) as being the second most important worldview in explaining general attitudes towards biotechnology. “Post-materialism” (against the thrust of technology to transform the world by artificial means) also made a significant contribution in their model. The current research is consistent with their findings and suggests that the business value sphere is a defining area in terms of explaining attitudes towards biotechnology.

Nature and the environment

Environmental values were seen as important influences by people in all five groups interviewed, and all groups noted the interrelatedness of everything in nature. A number of respondents in the science groups felt that biotechnology could be a very useful tool to aid in preservation, a belief echoed to a lesser degree by business people. In comparison, participants in the Buddhist, mother and environmentalist groups felt far more concerned about unknown long-term consequences of the technology on the environment. In addition, these groups emphasized the importance of respecting nature, rather than continually interfering (even with the best intentions).

Biotechnology might be able to fix up some of the problems we have caused, control of weed species for example and if I do anything to produce something that would wipe out ginger in the Coromandel, I left that behind as my legacy I'd be very proud. (Scientist)

I believe there is a natural order of nature and sure I'm not against technology on the whole, but I think sometimes you can fool around with it too much and it interferes totally with the whole order of nature and is that where we want to end up? (Business person)

Interventionist science is not what we need, we need a far better understanding of the interconnectiveness of ecosystems than we've ever needed. (Buddhist)

Interpretation of our findings can be aided by the examination of two of the worldviews described by Cook et al. (2004). In their study, the authors found that the “nature’s revenge” worldview (negative consequences of interference, playing God, unexpected outcomes, and irreversible harmful outcomes) was the most important of their five worldviews in explaining general attitudes towards biotechnology. In our research, this worldview can strongly be applied to the mothers, Buddhists and environmentalists.

Mother Nature is the most powerful woman on this world, she is the one who developed everything, she giveth, she taketh away, then she give back again, if you mess with her, she’ll do you harm, if you do good she’ll give you plenty. (Business person)

In contrast, while the environment was also very important to both scientists and business people, the “tech optimism” worldview (described above) appeared to have a greater degree of interaction with their views on the environment. “We’d want to use biotechnology to protect that. It’s actually utilising biotechnology to gain, to enhance those things” (Scientist).

Family and society

The health of society was mentioned by people in all five groups, with biotechnology generally seen in a positive light in these instances, making medical applications more acceptable than other applications. Mothers and Buddhists had perhaps the most to say regarding this value sphere. Neither community segment believed that advances in biotechnology would be available to those who could not afford it, resulting in a widening of the gap between rich and poor. Additionally, Buddhists were troubled by the values of greed promoted by some of the biotechnological advances. In this respect a strong negative link was made with the business value sphere. “This is a thing that rich people can pay for or rich countries can pay for and so I think that there is an equity argument there” (Buddhist).

Cook et al. (2004) did not identify family/society specifically as a worldview but aspects of two of their worldviews can be seen in this value sphere: tech optimism (described above) and God stewardship (people are given a role of responsibility to care for the welfare of living things).

Spirituality and religion

The impact of any formal religion on attitudes towards biotechnology was mentioned by very few participants in any group, although among the Buddhists, references were made throughout the discussion to some of the principles inherent in Buddhism. For instance, references were made regarding societal equity, the values of greed promoted by “big-businesses,” respect for nature, and an awareness of our impact on our environment.

And one of the highest values is about valuing human life, or life, not human life just life isn’t it? And that’s one of the highest ethics, it doesn’t have to be debated do you know what I mean, by the different parties going around this biotechnology issue, it’s a core, principle, ethic, and there are a few other ones too aren’t there? (Buddhist)

We’ve actually lost our capacity in general to relate from a more spiritual basis, which would actually give us clearer eyes into the value of this planet, what we’ve been given and how we might use it and you know. (Buddhist)

However, these comments were not confined only to Buddhist participants, since mothers and environmentalists also frequently expressed them. Mothers and Buddhists shared a “humanity” perspective, focusing on care and respect for everyone in society. Environmentalists emphasized our stewardship role of looking after nature for future generations (consistent with the

“human nature” perspective illustrated by Coyle et al. (2003) where humans hold a special position in nature that makes us accountable for our conscious actions toward the planet). This link between the responsibility to care for the welfare of living things and spirituality was also observed by Cook et al. (2004).

Is it to feed the starving people of the world then yeah, absolutely. Is it to make money then no. (Mother)

It’s the quality of life, like you were saying, whether they choose to let the child die or whether they choose to go along. It has to be managed and this has to be taken into account. Everything has to be taken into account. (Mother)

They are inheriting the world that we are leaving when well, passing on to them so that’s all important. (Environmentalist)

The stewardship principle is that as humans we have more control over this planet than anything else therefore we have the responsibility to look after it. We have to be very careful what we do with it. (Environmentalist)

In many cases, participants distanced themselves from the issue (particularly scientists) referring either to religious issues of which they were aware (such as Maori beliefs), or to their perception that science clashed with spirituality. Participants in our groups may not have felt sufficiently comfortable to reveal this type of information in such a forum. Coyle et al. (2003) have also reported a reticence on the part of the focus group members to discuss their spiritual beliefs.

Priority of values

Most groups experienced some difficulty in determining which values should take precedence over scientifically proven safety. While scientists, mothers and environmentalists commented that it would be difficult to develop a standardized set of ethics, because each person had a different boundary between acceptable and unacceptable, Buddhists felt that science didn’t contain an inherent ethical structure and needed to be directed by ethics, rather than the reverse. In contrast, some business people felt that we needed to move forward, and this might take precedence over spiritual considerations.

I think it’s very difficult you know because everyone has a different boundary and you know if you start talking about engineering babies for example, that’s beyond my boundary ... but probably not everybody’s by a long shot ... the next generation will have a different set of values and beliefs than this generation does, so you can only put boundaries in snapshot, at any one time and then they change, all the time so it’s a really difficult question to answer. (Scientist)

I think what we’re saying is that this is the area it starts [ethics], and then it filters down. It’s true. It can’t start with science because science doesn’t have a universal basis of ethics. (Buddhist)

The world has to go forward, we really have to move forward and that’s not just for different cultures, it’s everybody. We can’t isolate one round of people because it is generally for the good of the people, for the good of mankind, so people can put their stance on it and say well culturally that’s not good for us, but they’re the first ones to cry out for help too. (Business person)

While some scientists believed that sound science should come first, others felt that the Environmental Risk Management Authority (ERMA—an authority set up to make decisions

on applications to introduce new organisms or hazardous substances to New Zealand) would be the wrong body to deal with such matters.

4. Conclusions

Our findings are consistent with those of Gamble and Fisher (2002), who suggested that the value spheres involved in the issue of biotechnology could be linked by a complex tapestry of beliefs regarding control (or lack of), power (and the powerless), development (progress or greed), trust (or lack of), respect (of the environment and of humanity), safety (quality of food, quality of life) and choice (to avoid biotechnology, or make use of it).

In partial rejection of hypotheses 2, 3 and 5, rather than being influenced by their defining value spheres, Buddhists, mothers and environmentalists shared many commonalities in their worldviews. Of the five community segments, they were the least optimistic of the benefits of biotechnology, and expressed concern with the unknown long-term consequences on health and the environment. Additionally, they required strict regulations to control the technology. They were cynical and resentful of the physical and moral negative impacts that business (financial) considerations had on quality of life and preservation of nature, and expressed feelings of powerlessness, either in terms of being able to accumulate information to inform themselves, or in terms of their impact on decision-making. Nevertheless, if a biotechnology application could be deemed to fulfill a real need, could be contained, caused no loss of life or suffering and enabled choice on the part of the recipient, these participants were willing to accept specific biotechnology applications.

In terms of attitudes to progress, business people could be seen quite separately from the mothers, Buddhists and environmentalists. In this sense, we confirmed an adherence to the myth of productionism, which espouses the beliefs that more is better, problems can be solved by the application of technology, and progress is a good thing (hypothesis 4). This resulted in a greater acceptance of biotechnology, since business people did not hold the same resentment toward the business sphere that other community segments held. Business people were also more optimistic of the benefits the technology could provide to health and the environment than other community segments. However, the unknown consequences to health and the environment concerned business people, and they sought assurances that controls were in place to prevent the misuse of the technology.

The scientists in our study shared similar views to the other community segments: their concerns over who currently benefits from biotechnology; the importance of maintaining and preserving the environment for future generations; the ethical issues inherent in the use of animals for our benefit, and the stage at which an embryo becomes a life. This indicates that the value spheres of environment, and family/society do not define different segments of the community in terms of their opinions regarding biotechnology, but are instead important drivers across society. However, optimism that problems could be solved using technology and that progress was a good thing aligned the scientists with business people on the business sphere. However, what set scientists apart from the other four community segments was their acceptance of the norms and values inherent in the sphere of science, as typified by their tendency to see the world in terms of “atoms and scientific laws”—i.e. their view that science was more predictable and controllable than the public believed (in agreement with hypothesis 1). While they were optimistic that science would be used to remedy problems, they acknowledged the impossibility of a product or process being “proven safe” scientifically. In contrast, members of the other four groups were more inclined to require assurances that something was “proven

safe,” were more comfortable about speaking emotively rather than referring to “facts,” and often saw science as “meddling,” with unknown consequences.

The disparity in worldviews for the science sphere meant the scientist and the layperson did not communicate at the same level, despite having the same concerns for health, welfare of animals and the environment. Because each side is essentially speaking a “different language,” feelings of frustration and powerlessness have emerged on both sides. For instance, a prevalent view of scientists is that education is important for improving understanding by the public, thus alleviating concerns about unknown consequences and reducing the need for products to be “proven safe.” The emphasis on “facts” may have produced perceptions that scientists are patronizing, removed from the real world, and intimidating. In contrast, the public is looking for reassurances that the technology will not impact negatively on their quality of life which often involves less tangible issues dealing with their spirituality, environment and society. While scientific methods are useful when it comes to isolating specific, potential effects and making them tangible as facts and figures, they are of much less use when it comes to distinguishing between important and less important risks, and between matters of proof, reflection and negotiation (Meyer et al., 2005).

I think a scientific view of the world causes things to seem segmented rather than you know each thing is seen to be separate in the economic system. It's based on things crossing the marketplace. All sort of non tangible, very important things like human suffering, are not measured and so the scientific model encourages us to just value those things that can be measured. (Buddhist)

We mustn't lose sight of the fact that it is not black and white for each piece of research. We should keep our minds open to the fact that there are paths for researching the same result, scientifically and that one may be more promising or acceptable than another. (Environmentalist)

Recommendations

It is therefore imperative that the general community and scientists engage in dialogue that allows movement forward in a way that is constructive to all parties. Encouragingly, initiatives have been set in place to improve communication between these groups. For instance, in 2002 the New Zealand Ministry of Research, Science and Technology set up a dialogue fund of NZ\$450,000 per year to pilot initiatives that would create greater trust and confidence in science research and technological developments amongst New Zealanders. The aim of the fund was to develop pilot programs that engaged communities in discussion over science and technology related issues that were, or might become, a cause of tension between science and society and to build improved relationships between scientists and the community based on two-way communication (e.g. Lyver, Hayes and Horn, 2004; Roper, Zorn and Weaver, 2004). It is outside the scope of this paper to summarize the findings from such studies. However, a consistent finding from those projects has been that dialogue is most successful when it encourages the finding of common ground and the learning of each other's “language,” exploring ways in which the different stakeholders can connect while remaining open-minded about their differences. Nevertheless, the question of how to motivate the general public to become involved in what may often be quite intensive discussions has yet to be answered sufficiently. In addition, as suggested by Meyer et al. (2005) there is a need for the scientific community to reflect on questions such as “what kinds of questions is science able to answer, and what kind of answers is science able to question?,” “should science understand itself as

the key intellectual resource of public policies, or would it be better to provide more room for other intellectual resources, other sorts of reason?" and "how should demands for transparency, inclusion and participation be met and why?"

In terms of the current project, the large range of topics included in the study meant that each topic could only be discussed superficially. We recommend that a narrower range of topics be covered in further discussions, so as to delve more deeply into the underlying issues. In addition, we believe the issue of regulation/control and the related issue of liability have not been explored by any researcher in any great depth. This may be one area earmarked for further research.

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